ENGI 210
PROTOTYPING AND FABRICATION
Syllabus – Fall 2014

INSTRUCTOR

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COURSE ADMINISTRATION

Course Objectives and Outcomes

Students will acquire basic to intermediate-level proficiency in the physical fabrication of objects for engineering design related projects. Students will train with the instructor and other students but work individually on projects.

Course Objectives. Students should learn:

1. Advanced prototyping and fabrication skills useful in the construction of physical objects.
2. Sketching, drawing, and CAD as a medium to communicate and iterate initial prototype ideas.
3. Chaining together multiple manufacturing processes to convert an idea to a physical part.

Course Outcomes. Students completing this course will be able to:

1. Rapidly prototype, via models or sketching, rough ideas to communicate a project idea.
2. Prepare a 2D digital file and fabricate an object/part using a laser cutter or a plasma cutter.
3. Design a part or object using computer aided design with the correct dimensions, tolerances, and geometry to produce using manufacturing/fabrication techniques.
4. Produce a positive and negative of a designed part using a combination of advanced manufacturing techniques such as 3D printing, CNC Machining, and molding/casting.

Class Time and Location

Students are expected to be PROMPT (if not a few minutes early) to class. Students are expected to stay until the end of class, even during open work periods. Specific dates will require students to sign up for times outside of class for supplemental training or due to the limits of number of students/machine. These times will be selected the second day of class so students will have time to schedule around other obligations.

Class meets regularly on Tuesdays and Thursdays 1:00 – 2:15pm.

Class will be held in the **OEDK Classroom and respective computer lab rooms**.

Attendance Policy

Students are required to attend **ALL** sessions of the class. Job interviews, medical school interviews, other classes, or extracurricular activities are not valid excuses. Students choosing to miss a class for another commitment must speak with Dr. Wettergreen to discover a way to learn the content and complete the required assignments. Illness and family emergencies will be dealt with on an individual basis. Contact Dr. Wettergreen immediately as soon as an emergency arises.

Safety

This class utilizes tools and processes that can seriously injure you or those around you. All students are expected to work safely in this class adhering to the policies and safety requirements of the OEDK and any additional requirements based on the class. Most class sessions will be conducted with safety glasses on. Additionally, students must wear long pants, shirts with shoulders, and close-toed shoes. Students not adhering to these policies will be sent home to change.

Honor Code Policy

Much of the learning in this lab comes from one-on-one coaching and interaction with other students and the instructor. It is important that a collegial environment is present. For all exercises and homework each student will complete their own work for each tool/technique but are free to discuss strategies and best practices with all other students, Dr. Wettergreen, and other OEDK technicians.

COURSE CONTENT

Class Activities and Support

Class time will be used in a variety of ways, including short lectures, active learning, individual work, partnered work, tutorials, and student oral presentations. Active listening and participation is essential at all points during this class.

Textbook and Digital Resources

There is no course pack or textbook for this class. All pertinent content will be delivered in class so students will need to maximize the existing class time to learn the technologies and practice them with the instructor and peers in attendance. Supplemental resources will be made available on Owlspace for each topic in the form of documentation, additional references, and video tutorials, where possible.

Engineering notebooks

Having a regular routine for documenting your ideas, sketches, and calculations is a useful skill for engineers. This course will help you to develop this skill by requiring you to keep an engineering notebook. This notebook should contain all of your process notes, ideas, work, hand drawings, calculations, and sketches that relate to the tools taught in this course. Any bound notebook will suffice as an engineering notebook; a grid or dot pattern is recommended because it allows you to sketch with proportion and straight lines.

Software Resources

All computers with an engineering build should have the necessary programs installed. This specifically includes Mudd Lab and the OEDK computers at the least.

There are additional programs that may be useful for you to install on your personal computers. Some are listed here:

- Gimp, photo editing program, free, (gimp.org)
- Inkscape, vector drawing program, free, (inkscape.org)
- Autodesk 123D, Suite of modeling products, mostly free, (123dapp.com)

Table 1. Course Schedule, Topics, and Homework

Week	Tuesday	Thursday	Homework
1	Introduction	Sketching/Drawing	H01 - Final Project Ideas - Sketches
2	Taking Things Apart	Putting Things Together	H02 - Low Fidelity Prototype of an iPad Holder
3	2D Drawing	2D Drawing Vinyl Cutter	H03 - Final Project Ideas - 2D Drawings
4	Laser Cutter	Laser Cutter*	H04 - Laser Cut an engineering related part
5	Plasma Cutter	Plasma Cutter*	H05 Plasma Cut an engineering related part
6	Project Time	Project Time	P01 - Make a Press-Fit Construction System
7	Project Time	Project Time	
8	FALL RECESS – NO CLASS	Project Presentations	
9	3D Drawing	3D Drawing	H06 - Final Project Ideas - 3D Drawings
10	CNC Machine	CNC Machine*	H07 - CNC an engineering part
11	3D Printing	3D Printing	H08 - 3D Print an object with complex internal geometry
12	Molding/Casting	Molding/Casting	H09 - Cast a finger
13	Project Time	Project Time	P02 - Cast an object from the CNC Machine that was designed with 3D Design
14	Project Time	THANKSGIVING BREAK – NO CLASS	
15	Project Time	Project Time	
FINAL TIME	Project Presentations		

*During these times students will work in pairs to complete the assignments

ASSIGNMENTS and GRADING

ENGI 210 includes 9 weekly assignments and two major projects. Homework is assigned on Thursday in class and due at the beginning of class the following Thursday. The weekly assignments are designed to demonstrate

that you have successfully applied or learned a discrete tool or technique. Each Thursday there will be a brief review of the homework where there will be time for immediate feedback from peers and instructor on best practices.

One additional assignment of equal weighting to a weekly assignment will evaluate your usage of your engineering notebook. This grade will be based on how complete your notebook is in documenting process, sketches, notes, and work completed in the course.

The two major projects will involve the use of multiple tools and techniques chained together. These projects will require you to conceive of the idea and design and build it. These projects will extend your capabilities using these prototyping and fabrication techniques. These projects will constitute the majority of your grade and be presented in class and during your final in a formal critique.

Online Documentation

A hallmark of engineering design work is process documentation. In this course we will be utilizing a blog to document our ideas, processes, and work. In addition to showcasing student work in class, each homework assignment will be documented online as a blog post on the course blog. These posts do not need to be long in text, but they should include sketches from your engineering notebook as well as process photos and documentation of successes and failures. Documenting your work on the course blog is meant to introduce you to the idea of transparent documentation and to stimulate discussion with your peers and mentors about the fabrication process.

Table 2. Assignment Schedule

#	Assignment	Assigned	Due Date
1	Final Project Ideas - Sketches	8/28	9/4
2	Low Fidelity Prototype of an iPad Holder	9/4	9/11
3	Final Project Ideas - 2D Drawings	9/11	9/18
4	Laser Cut an engineering related part	9/18	9/25
5	Plasma Cut an engineering related part	9/25	10/2
6	Make a Press-Fit Construction System	9/25	10/16
7	Final Project Ideas - 3D Drawings	10/23	10/30
8	CNC an engineering part	10/30	11/6
9	3D Print an object with complex internal geometry	11/6	11/13
10	Cast a finger	11/13	11/20

11	Cast an object from the CNC Machine that was designed with 3D Design	11/13	FINAL TIME

Table 3. Calculation of Course Grade

Assignment	**% Final Grade**
Weekly Assignments (10 Total)	50
First Project	20
Second Project	30
TOTAL POINTS	**100**

Late Policy

For Student: Homework is due on Thursdays as indicated in Table 2. If an assignment is turned in late, the grade will be reduced 10% per day.

For Instructor: Homework will be graded and returned within 24 hours of student submission. For every 12 hours after this point the grade will be increased by 10%.

Any student with a documented disability needing academic adjustments or accommodations is requested to speak with me during the first two weeks of class. All discussions will remain confidential. Students with disabilities should also contact Disability Support Services in the Allen Center.